

Pharmaceutical removal from wastewater - Case Study

Testing a nanomaterial hollow-fibre membrane filter to eliminate pharmaceuticals from wastewater – A feasibility pilot study from a human health perspective

A collaboration between the University's Institute of Health Research and Innovation, the Environmental Research Institute and PolyCatUK Ltd.

Developing effective and sustainable solutions to address the issue of pharmaceutical presence in wastewater, especially those emitted from healthcare facilities like hospitals, is becoming increasingly important. Whilst potential environmental (i.e., ecotoxicological) impacts of pharmaceutical pollution are now recognised, there is still a lack of clarity as to the potential for harm to human health.



Materials and surfaces coated with metallic nanoparticles have shown promising results in the removal of various contaminants (like heavy metals) from water. Nanomaterials have the potential to provide an extremely large surface area (up to 1000 square metres per cubic centimetre) for effective toxic compound adsorption or chemical modification, whilst being suitable to be implemented in small-scale filter cartridge devices.

This Water Quality Innovation Group Challenge Fund project was designed to establish proof of principle that nanomaterials have the capacity to remove selected common drugs like paracetamol from water. The project made use of a prototype manganese oxide coated hollowfibre membrane filter cartridge provided by PolyCatUK Ltd - an Oxfordshire based company.

This prototype filter (previously shown to successfully remove heavy metals), was tested in a novel experimental rig designed to measure drug concentrations before and after nanomaterial exposure and to assess drug removal efficiency. The filter was applied to paracetamol, at concentrations in a range relevant to that found in human urine. Results clearly showed that the filter had the capability to remove paracetamol from water, establishing proof of principle.

The project will now be taken forward as part of a PhD scholarship awarded to the University through the HydroNation scholars programme. This project will again be a partnership between the Division



Experimental rig design with nanomaterial filter cartridge from PolyCatUK Ltd.

of Biomedical Sciences as part of the Institute of Health Research and Innovation and the Environmental Research Institute, involving the now cemented industry link with PolyCatUK Ltd.

For further details regarding this pilot study and the upcoming research in this field, please contact Professor Alistair Kean (Alistair.Kean@uhi.ac.uk) (Medical Nanotechnology), Professor Ian Megson (Ian.Megson@uhi.ac.uk) (Head of Health Research and Innovation), both based in the Division for Biomedical Sciences in the Institute of Health Research and Innovation, Inverness; or Dr Mark Taggart (Mark.Taggart@uhi.ac.uk), Dr Szabolcs Pap (Szabolcs.Pap@uhi.ac.uk) at the Environmental Research Institute, Thurso.